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Temporal Variation of Catch rate and Length Frequency of *Clupeonella cultriventris* (Nordmann, 1840) in Southwest of the Caspian Sea (Bandar-e Anzali)

Majid Koohani[1*], Seyed Yousef Paighambari[1], Afshin Adeli[1], Ali Asghar Ghorbani[2]

[1]Faculty of Fisheries and Environment, Gorgan University of Agricultural Sciences and Natural Recourses, Iran
[2] Institute of Fisheries, Guilan province, Iran.
*Corresponding Author: Majid.kohani@yahoo.com

Temporal Variation of Catch rate and Length Frequency of *Clupeonella cultriventris* was studied in the fishing grounds of Guilan province during 1st January to 10th December 2011. There was a significant difference between the mean CPUE of different depths and seasons. The total lengths of 921 specimens were recorded during the study period ranged from 69 mm to 139 mm. The contribution of Common Kilka (*C. cultriventris caspia*), Big-eye Kilka (*C. grimmi*) and Anchovy Kilka (*C. engrauliformis*) from the total catch was 97.6, 1.08 and 1.3 %, respectively. Length–frequency distribution of the *C. cultriventris* had differed significantly among the examined seasons for seasonal variation in the size structure of their populations. The present study indicates that the season is important determinant of the capture rate and the size composition of lift net catches. Lowest CPUE was caught in spring season and highest was summer. The data collected in this study can be used as the basis for a long-term stock monitoring program in the region.

Key words*:* *Clupeonella cultriventris, Catch rate, Length frequency, Caspian Sea*

1. INTRODUCTION

Caspian Sea is a brackish lake whose costal area is shared by Iran, Russia, Azerbaijan, Turkmenistan and Kazakhstan. The Caspian Sea has a volume of 77,000 km^3 and a surface area of about 436,000 km^2 (Aladin and Plotnikov, 2004). Three species of Kilka (*Clupeonella* spp.) are commercially important in the Caspian Sea and in the past decade they account for more than 80% of the total catch (Mamedov, 2006). These species are Anchovy Kilka (*Clupeonella engrauliformis*, Bordin, 1904), Big-eye Kilka (*Clupeonella grimmi*, Kessler, 1877) and Common Kilka (*Clupeonella cultriventris* caspia, Nordmann, 1840).

In the Iranian coastal waters of the Caspian Sea, Kilka was important source of income and protein. All the three Kilka species are caught by commercial fisheries that use lift nets in Iranian waters or fish pumps with underwater electric lights (Nikonorov, 1964, Fazli, 2009). Annual catch of Kilka increased to maximal levels of about 423,000 mt (metric tonnes) in 1970 (Ivanov, 2000). When Kilka accounted for about 70% of total fish catch in the Caspian Sea (Sedov et al., 1997, Fazli, 2009). Kilka fishing in Iran started with six vessels in the Bandar-e Anzali in 1970 until 1976; annual Kilka catch was less than 4000 mt (Razavi, 1993; Fazli, 2009).

The seasonal variation in abundance of freshwater, estuarine and marine fish species in estuarine habitats is a result of both the environmental factors (rainfall and salinity) and a suite of biological variables (including reproduction and recruitment).

A number of studies including different aspects of biology from the coast of Azerbaijan, Caspian Sea (Mamedov, 2006), population dynamics and biological characteristics (Mazandaran waters, Babolsar) (Karimzadeh et al., 2010) and natural fishing and total mortality, survival and exploitation rates from the southeastern coast of Caspian Sea (Babolsar) (Karimzadeh, 2010) on these species have been conducted.

Information about temporal variations of catch rate and length frequency appears to be useful in management of stock fish. Although, knowledge about temporal variations of catch rate of *C. cultriventris caspia* is very slight and disperse.

The objective of the present study was to determine temporal variation of catch rate and length frequency of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali).

2. MATERIALS AND METHODS

2.1. Study Area and Sampling Stations

Data was collected from fishing grounds in southwest of Caspian Sea on monthly basis during 1st January to 10th December 2011. The survey area was restricted to Guilan coastal water and covers fishing grounds of *C. cultriventris* (Fig. 1).

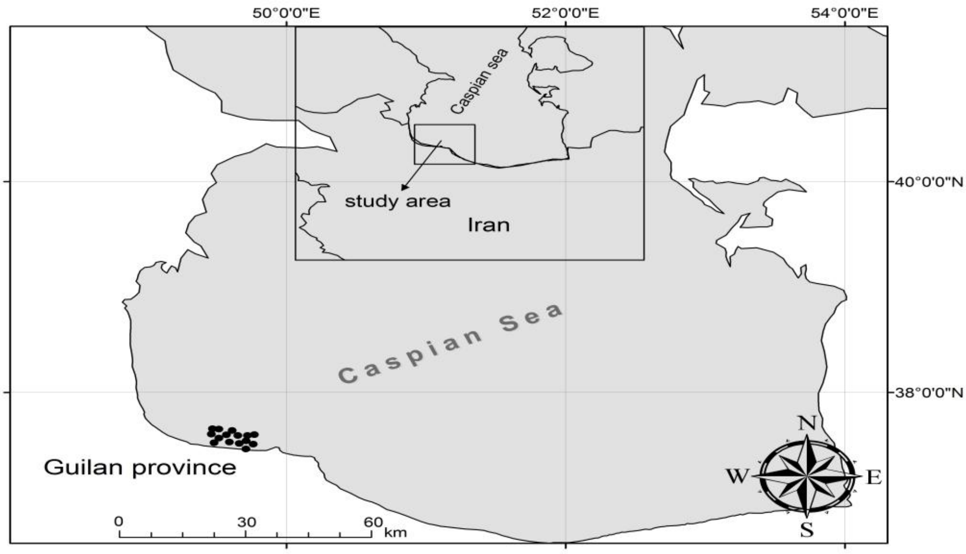

Fig. 1: The area of study. South west of Caspian Sea was selected as the examination region.

2.2. Sampling

CPUE (kgn^{-1}) was calculated by dividing total catch on fishing efforts. Fishing was made at night using the traditional commercial vessels and a conical lift net with 3 kW and 6 kW light to attract the Kilka fish. The samples were initially sorted into different classes considering 5 mm total length intervals with the weight (±0.1 g) and total length (±1 mm) accuracy. The sex of the fish was determined by macroscopic examination of the gonads.

2.3 Data Analysis

Shapiro–Wilk's and Levene tests were used to analyze normality of the data and homogeneity of variances, respectively (Zar, 1999). Since the assumptions of parametric statistics could not be met, a non-parametric Kruskal–Wallis test with a 5% level of significance was used to find the significant differences in mean CPUE among the species. A non-parametric U Mann-Whitney test was used for paired comparison among seasons. All the statistical analyses were considered at a significance level of 5% ($P<0.05$).Kolmogorov–Smirnov tests were used to determine whether the size composition of individual *C. cultriventris* was significantly differed between seasons and depth. Because this is a pair-wise comparison, interactions between season and depth were not considered. Chi-square test was used for assessing sex ratio among seasons (Zar, 1999).

3. RESULTS AND DISCUSSION

The contribution of Common Kilka (*C. cultriventris caspia*), Big-eye Kilka (*C. grimmi*) and Anchovy Kilka (*C. engrauliformis*) from the total catch was 97.6, 1.08 and 1.3%, respectively.

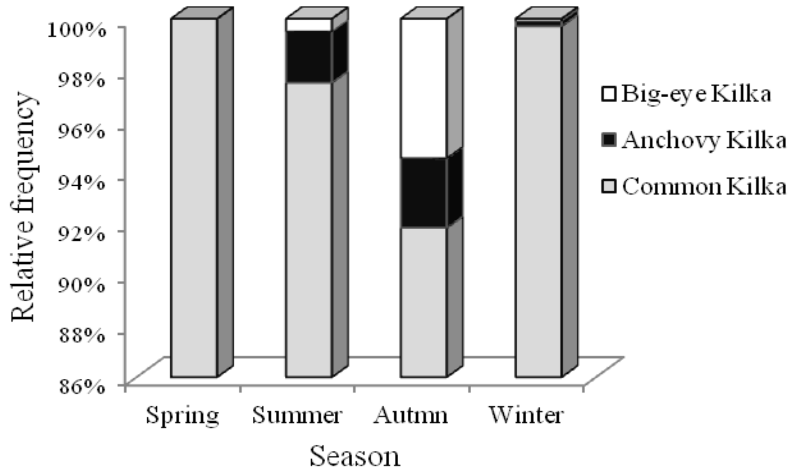

Fig. 2: Contribution of various species of Kilka in different seasons

The mean catch per unit of effort in different seasons is given in Table 1. Mean catch rates of the *C. cultriventris* differed significantly among seasons with lowest catches in spring ($P<0.05$) (Table 1). CPUE of the *C. cultriventris* didn't differ significantly between autumn and winter ($P<0.05$).

Table 1: Mean CPUE for *C. cultriventris* in the fishing grounds of Guilan.

			CPUE (Kgn^{-1})			
Species	n	Season	Mean	S.E	Min	Max
	10	Spring	9^{a}	2.17	0	20
C. cultriventris	111	Summer	86.63^{b}	7.11	10	387
	99	Autumn	47.93^{c}	2.52	1	125
	67	Winter	44.58^{c}	3.43	0	110

S.E: standard error; Min: minimum, Max: maximum

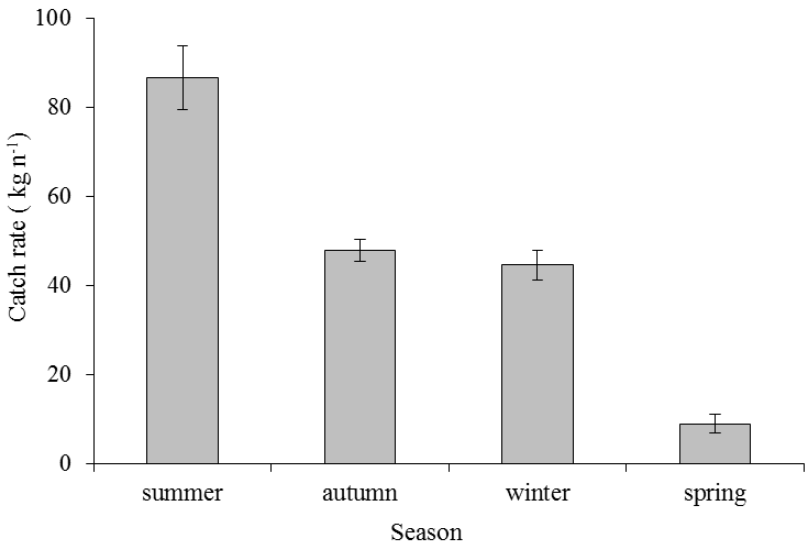

Fig. 3: Mean catch rates ± S.E ($kg\ n^{-1}$) of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) among different seasons.

The total length of 889 collected specimens during the study period was ranged from 69 mm to 139 mm.

Length–frequency distribution of *C. cultriventris* was differed significantly among the examined seasons for seasonal variation in the size structure of their populations. Kolmogorov–Smirnov tests showed that *C. cultriventris* had significantly higher proportions of smaller individuals in summer (Fig. 3). More number of smaller fish was encountered during autumn and smaller sizes during spring.

Length range of 109-114mm was dominated size classes with 14.87% and 31.85% in summer and autumn respectively. Size 114-119 mm and 99-104 mm were dominated size classes with 26.05% and 18.82% in winter and spring respectively.

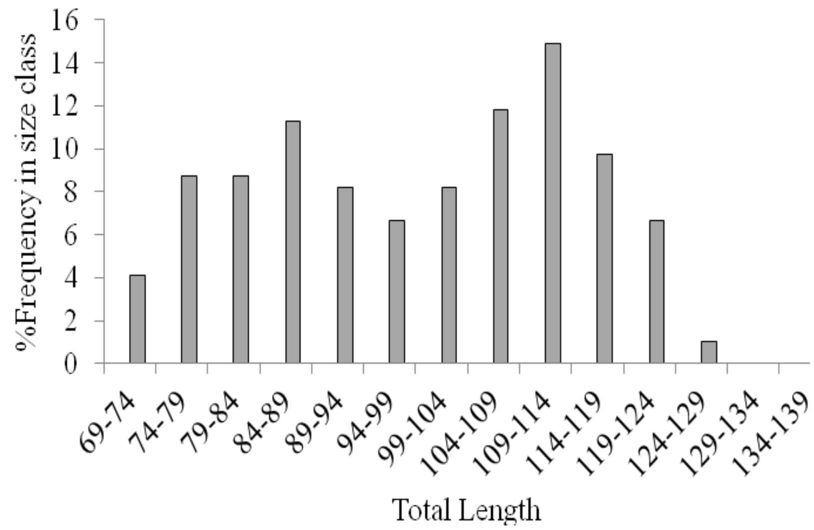

Fig 4: Length frequency distribution of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) in summer.

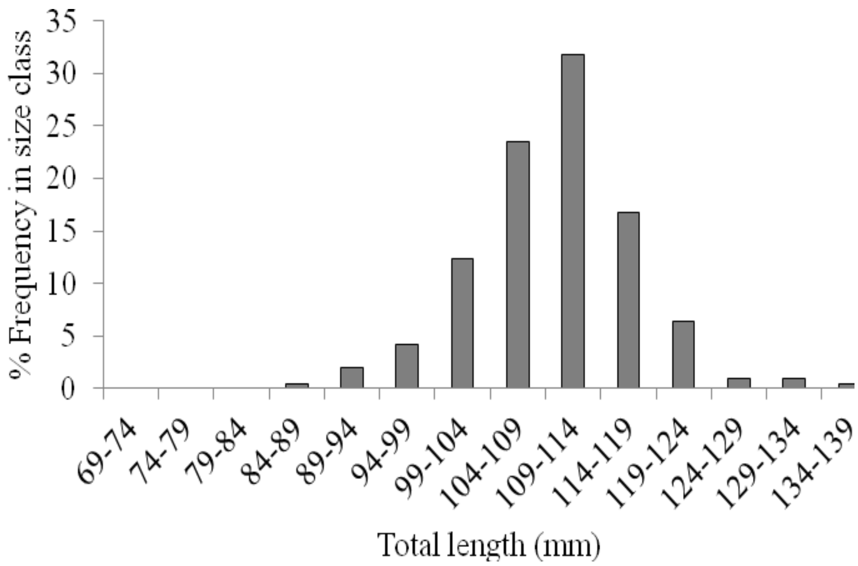

Fig 5: Length frequency distribution of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) in autumn.

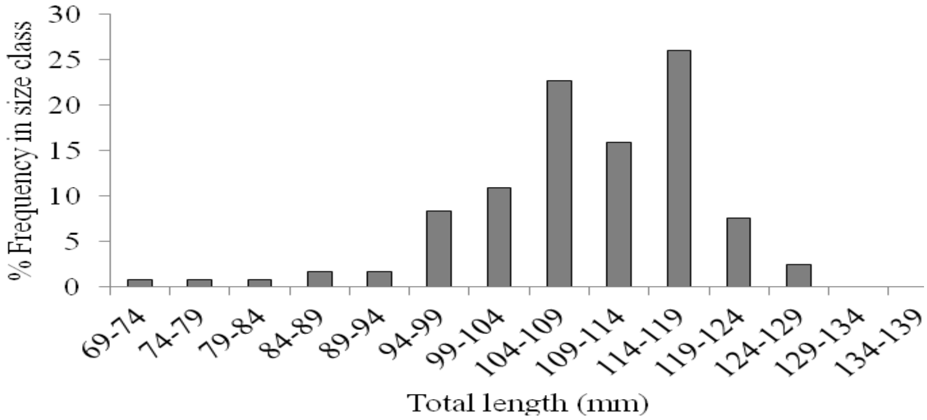

Fig. 6: Length frequency distribution of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) in winter.

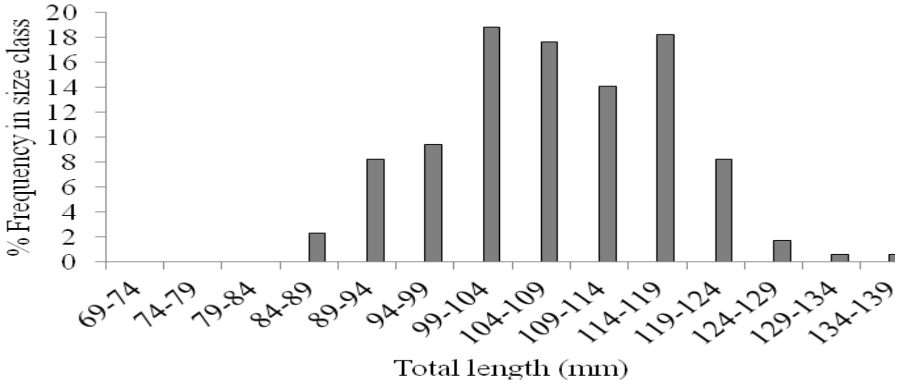

Fig. 7: Length frequency distribution of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) in spring.

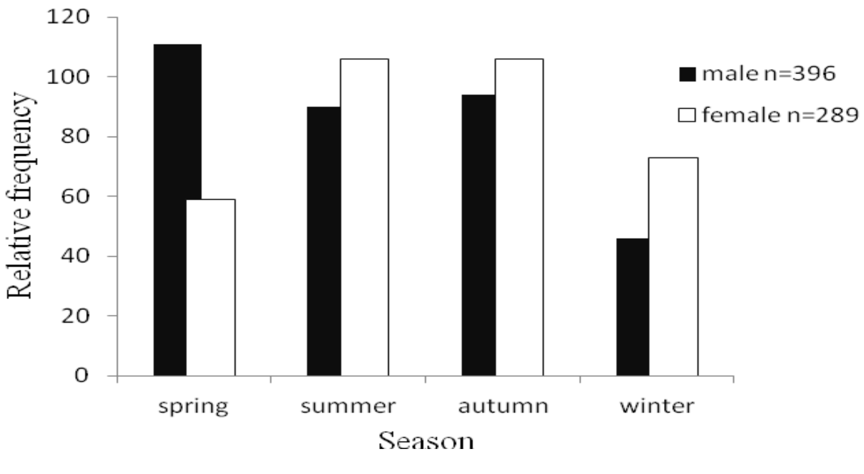

Fig. 8: Sex ratio of *C. cultriventris* in Southwest of the Caspian Sea (Bandar-e Anzali) in spring.

Sex ratio had significant difference in spring ($\chi2 = 15.90$, $p < 0.001$) and winter ($\chi2 = 6.12$, $p < 0.05$). Our results show that the season is important determinant of the capture rate and the size composition of *C. cultriventris*. Lowest CPUE was obtained in spring season. Spring is spawning season for *C. cultriventris* in Caspian sea and highest GSI has been estimated in this season (Krasnovoa., 1947), also *C. cultriventris* not attack by light in spawning season (Janbaz et al, 2008). Results showed that there was a significant difference for sex ratio in spring. This may be due to lack of females' attraction by light in spawning season.

Additionally, differences in the size composition of the catch have also been observed in season catches (Beamish, 1966; Walsh, 1988; Engas and Soldal, 1992), which suggest recruitment is seasonal. The mean catch rate of C. cultriventris in autumn, winter and summer cruises (47.93 and 44.54 and 86.63 Kg.n-1) indicates that this species may have the commercial potential of Caspian Sea in these seasons.

Nowadays Kilka is fished commercially mainly in the southern Caspian Sea and at least until the recent sudden decline in catches, the annual harvest was 80000-150000 tones (Mamedov, 2006). Kilka stocks are declining anually. The stock of the main commercial species such as Anchovy Kilka is apparently unable to recover from its total recruitment failure in April and May of 2001, when 100000-270000 tonse of Kilka (10-40% of the stock) died (Tarasov, 2001), possibly as a result of a natural event (Mamedov, 2006). According to the results of the study on catch and CPUE rate, it can be said that relative abundance of *C. cultriventris* stock has shown an increasing trend in the catch comparison with respect to the past decades. This may be due to the increasing fishing effort and habitat expansion and changes in living depths. Compare to that past years, the stocks of Anchovy and Big eye Kilka decreased. This can be due to overfishing and natural factors (Karim zade, et al, 2010).

At present study 12 Anchovy Kilka fish were caught per haul, it indicate that CPUE of this species has been decreased compared reports of Sedov et al. (2004) and Mamedov (2006). Kilka catches over the past few years have contained virtually no juvenile anchovy Kilka. Such fish now account for only 0.2-0.6% of the total catch, clear evidence of poor recruitment of the species (Mamedov, 2006). Anchovy kilka fecundity studied on the basis of survey hauls varied from 8510 to 58340 mature oocytes per fish, averaging 35876 oocytes, close to Sedov and Paritskiy's (2001) recorded fecundity of 9800 to 61000, with a mean of 38400. The data collected in this study can be used as the basis for a long-term stock monitoring program in the region.

4. CONCLUSION

With respect to gained information it can be concluded that temporal variation affect length frequency and catch rate significantly and it should be considered as very important factor. The data collected in this study can be used as the basis for a long-term stock monitoring program in the region.

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